SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Brush Lake County: Brookings

Legal Description: T110N-R52W-Sec. 19, 20, 30

Location from nearest town: 2 miles south, ½ mile east of Arlington, SD

Dates of present survey: June 29-July 1, 2010

Date last surveyed: July 2-3, 2008

Managed Species	Other Species
Walleye	Northern Pike
Yellow Perch	Green Sunfish
Black Bullhead	White Sucker
	Yellow Bullhead

PHYSICAL DATA

Surface Area: 386 acres Watershed area: Unknown

Maximum depth: Unknown
Contour map available: No

Mean depth: Unknown
Date mapped: NA

Beneficial use classifications: (9) fish and wildlife propagation, recreation and stock

watering.

Ownership of Lake and Adjacent Lakeshore Properties:

Brush Lake was so named because of the abundance of brush found along its shorelines. It is listed as a meandered lake in the State of South Dakota Listing of Meandered Lakes and the fishery is managed by the South Dakota Department of Game, Fish, and Parks (GFP). Most of the east and south shoreline is owned by the United States Fish and Wildlife Service. The north shore is considered a public right-of-way for US Highway 14. The remainder of the shoreline is privately owned.

Fishing Access:

There is a grassy shoreline on the south shore of the lake where small boats can be launched with difficulty. There are several areas suitable for shore fishing on the public properties described above.

Field Observations of Water Quality and Aquatic Vegetation:

Water quality during the survey was good with a Secchi depth measurement of 122 cm (48 in) although some areas of the lake had visible densities of green and blue-green algae. Dense beds of sago pondweed (*Potamageton pectinatus*), clasping leaf pondweed (*Potamageton richardsonii*) and northern water milfoil (*Myriophyllum verticillatum*) were observed around the entire lake and cattail was observed in several of the shallow bays.

BIOLOGICAL DATA

Methods:

Brush Lake was sampled on June 29-July 1, 2010 with three overnight gill-net sets and ten overnight trap-net sets. The trap nets are constructed with 19-mm-bar-mesh ($\frac{3}{4}$ in) netting, 0.9 m high x 1.5 m wide (3 ft high x 5 ft wide) frames and 18.3 m (60 ft) long leads. The gill nets are 45.7 m long x 1.8 m deep (150 ft long x 6 ft deep) with one 7.6 m (25 ft) panel each of 13, 19, 25, 32, 38 and 51-mm-bar-mesh ($\frac{1}{2}$, $\frac{3}{4}$, 1, $\frac{11}{4}$, $\frac{11}{2}$, and 2 in) monofilament netting. Sampling sites are displayed in Figure 4.

Results and Discussion:

Gill Net Catch

Yellow perch comprised 46.5% of the gill net sample followed by black bullhead (29.0%) and walleye (22.4%) (Table 1). Other species included white sucker, northern pike, and yellow bullhead.

Table 1. Total catch from three overnight gill net sets at Brush Lake, Brookings County, June 29-July 1, 2010.

Species	Number	Percent	CPUE ¹	80% C.I.	Mean CPUE*	PSD	RSD-P	Mean Wr
Yellow Perch	154	46.5	51.3	<u>+</u> 4.2	24.9	7	7	103
Black Bullhead	96	29.0	32.0	<u>+</u> 7.1	57.9	21	0	108
Walleye	74	22.4	24.7	<u>+</u> 2.3	29.1	56	13	101
White Sucker	3	0.9	1.0	<u>+</u> 0.7	0.5			
Northern Pike	2	0.6	0.7	<u>+</u> 0.4	2.1			
Yellow Bullhead	2	0.6	0.7	<u>+</u> 0.9	0.4			

^{*} Five years (2000, 2002, 2004, 2006, 2008).

Table 2. Catch per unit effort by length category for various fish species captured with gill nets in Brush Lake June 29-July 1, 2010.

Species	Substock	Stock	S-Q	Q-P	P+	All sizes	80% C.I.
Yellow Perch	6.3	45.0	42.0		3.0	51.3	<u>+</u> 4.2
Black Bullhead		32.0	25.3	6.7		32.0	<u>+</u> 7.1
Walleye	3.3	21.3	9.3	9.3	2.7	24.7	<u>+</u> 2.3
White Sucker		1.0			1.0	1.0	<u>+</u> 0.7
Northern Pike		0.7	0.3	0.3		0.7	<u>+</u> 0.4
Yellow Bullhead		0.7	0.7			0.7	<u>+</u> 0.9

Length categories can be found in Appendix A.

¹ See Appendix A for definitions of CPUE, PSD, RSD-P and mean Wr.

Trap Net Catch

Black bullheads made up 74.1% of the trap net sample followed by yellow perch, walleye, white sucker, northern pike, and green sunfish (Table 2).

Table 3. Total catch from ten overnight trap net sets at Brush Lake, Brookings County, June 29-July 1, 2010.

Species	No.	%	CPUE	80% C.I.	Mean CPUE*	PSD	RSD-P	Mean Wr
Black Bullhead	318	74.1	31.8	<u>+</u> 17.8	187.8	20	1	98
Yellow Perch	72	16.8	7.2	<u>+</u> 2.5	0.2	10	10	101
Walleye	23	5.4	2.3	<u>+</u> 1.1	2.4	96	65	94
White Sucker	12	2.8	1.2	<u>+</u> 0.7	0.6	100	100	99
Northern Pike	2	0.5	0.2	<u>+</u> 0.2	1.3			
Green Sunfish	2	0.5	0.2	<u>+</u> 0.2	0.2			

^{*} Four years (2000, 2004, 2006, 2008)

Table 4. Catch per unit effort by length category for various fish species captured with trap nets in Brush Lake June 29-July 1, 2010.

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Species	Substock	Stock	S-Q	Q-P	P+	All sizes	80% C.I.
Black Bullhead	8.0	31.0	24.8	5.8	0.4	31.8	<u>+</u> 17.8
Yellow Perch	2.2	5.0	4.5		0.5	7.2	<u>+</u> 2.5
Walleye		2.3	0.1	0.7	1.5	2.3	<u>+</u> 1.1
White Sucker		1.2			1.2	1.2	<u>+</u> 0.7
Northern Pike		0.2		0.2		0.2	<u>+</u> 0.2
Green Sunfish		0.2	0.2			0.2	<u>+</u> 0.2

Length categories can be found in Appendix A.

Walleye

Management objective: To maintain a walleye population with a gill-net CPUE of at least 15, 25 cm (10 in) or longer fish in three out of five lake surveys.

The walleye population in Brush Lake is currently exceeding the management objective. Half the walleyes sampled this year were age-1 fish (Table 6 and Figure 1) that were likely stocked in 2009 (Table 7). Six other year classes were also sampled including a twelve year old fish. Natural reproduction does occur in Brush Lake since the ages of some sampled walleyes do not correspond with stocked years (Table 11). Walleye growth is very fast with fish reaching 420 mm (16.5 in) before age-3.

Table 5. Walleye gill-net CPUE, PSD, RSD-P, and mean Wr for Brush Lake, Brookings County, 2002-2010.

	2002	2003	2004	2005	2006	2007	2008	2009	2010	Mean*
CPUE	13.0		6.0		92.7		18.3		24.7	29.1
PSD	97		50		18		14		56	43
RSD-P	0		33		1		0		13	7
Mean Wr	105		91	•	98	•	95	•	101	94

^{*}Five years (2000, 2002, 2004, 2006, 2008)

Table 6. Weighted mean length at capture (mm) for walleye captured in gill nets in Brush Lake, Brookings County, 2010. Sample size is in parentheses.

Year	1	2	3	4	5	6	7	8	9	10	11	12
2010	252	420	468	493	511	582						591
(74)	(38)	(2)	(7)	(20)	(5)	(1)						(1)

Yellow Perch

Management objective: To maintain a yellow perch population with a gill-net CPUE of at least 25, 13 cm (5 in) or longer fish in three out of five lake surveys.

Yellow perch CPUE has been steadily increasing since 2006 (Table 7). The 2008 increase was due to good natural reproduction in 2007 while the 2010 increase can be attributed to the fingerling stocking in 2009 (Table 8; Figure 2) since all the age-1 perch sampled this year were marked with oxytetracycline. Surprisingly, only a few fish from the 2007 year class were sampled suggesting high natural mortality or high fishing mortality.

Table 7. Yellow perch gill-net CPUE, PSD, RSD-P, and mean Wr for Brush Lake, Brookings County, 2002-2010.

	2002	2003	2004	2005	2006	2007	2008	2009	2010	Mean*
CPUE	54.7		3.7		3.3		29.3		51.3	24.9
PSD	49		45		30		4		7	31
RSD-P	6		0		30		2		7	8
Mean Wr	95		100		97		94		103	97

^{*}Five years (2000, 2002, 2004, 2006, 2008)

Table 8. Weighted mean length at capture (mm) for yellow perch captured in gill nets in Brush Lake, Brookings County, 2010. Sample size is in parentheses.

Year	1	2	3	4	5	6	7	8
2010	144		299					
(154)	(145)		(9)					

Black Bullhead

Management objective: Maintain a black bullhead population with a trap-net net CPUE of less than 100.

Black bullhead trap-net CPUE increased in 2010 (Table 9), but is still within the management objective. The fish sampled ranged in length from 11 to 40 cm (4.3 to 15.7 in) (Figure 3). There seems to be a weak correlation between walleye abundance and bullhead abundance over the last ten years (Table 5 and Table 9). Bullhead abundance increased in 2006 after walleye abundance reached a ten-year low in 2004.

Table 9. Black bullhead trap-net CPUE, PSD, RSD-P and mean Wr for Brush Lake, Brookings County, 2002-2010.

	2002	2003	2004	2005	2006	2007	2008	2009	2010
CPUE			14.2		208.2		13.8		31.8
PSD			19		1		42		20
RSD-P			17		1		13		1
Mean Wr			93	•	90		97	•	98

All Species

Brush Lake contains good numbers of walleye and yellow perch with few undesirable fish. No carp or buffalo have ever been sampled in the lake (Table 6). A smallmouth bass was caught during the spring 2010 walleye spawning operation.

Table 10. Gill-net (GN) and trap-net (TN) CPUE for all fish species sampled in Brush Lake, Brookings County, 2002-2010.

Species	2002	2003	2004	2005	2006	2007	2008	2009	2010
WHS (GN)			1.0		1.3				1.0
WHS (TN)			0.2		0.8		1.8		1.2
BLB (GN)	93.7		2.7		25.0		1.0		32.0
BLB (TN)			14.2		208.2		13.8		31.8
YEB (GN)					2.0				0.7
YEB (TN)					8.0				
NOP (GN)	6.3		2.7		1.3				0.7
NOP (TN)			1.8		3.0		0.5		0.2
GSF (GN)									
GSF (TN)					0.2		0.5		0.2
YEP (GN)	54.7		3.7		3.3		29.3		51.3
YEP (TN)					8.0				7.2
WAE (GN)	13.0		6.0		92.7		18.3		24.7
WAE (TN)			2.0		6.0		2.8		2.3

WHS (White Sucker), BLB (Black Bullhead), YEB (Yellow Bullhead), NOP (Northern Pike), GSF (Green Sunfish), YEP (Yellow Perch), WAE (Walleye).

MANAGEMENT RECOMMENDATIONS

- 1. Stock walleye fingerlings at a rate of 100/acre as needed to maintain the management objective.
- 2. Stock yellow perch fingerlings at a rate of 500/acre as needed to accomplish and maintain the management objective.
- 3. Evaluate all management activities by conducting lake surveys every other year.

4. Include the areas connected by culverts in future fish stocking and other management activities.

Table 11. Stocking record for Brush Lake, Brookings County, 1992-2010.

Year	Number	Species	Size
1992	130,000	Northern Pike	Fry
	827	Northern Pike	Adult
1997	3,280	Yellow Perch	Adult
1998	40,000	Walleye	Fingerling
	2,025	Yellow Perch	Adult
1999	30,000	Walleye	Fingerling
2001	4,572	Yellow Perch	Adult
2002	31,140	Walleye	Fingerling
	14,896	Yellow Perch	Juvenile
2004	44,400	Walleye	Fingerling
2005	38,600	Walleye	Fingerling
2006	40,220	Walleye	Fingerling
	435	Yellow Perch	Adult
2009	1620	Walleye	Large Fingerling
	6561	Walleye	Small Fingerling
	244,339	Yellow Perch	Fingerling
2010	39,550	Walleye	Small Fingerling

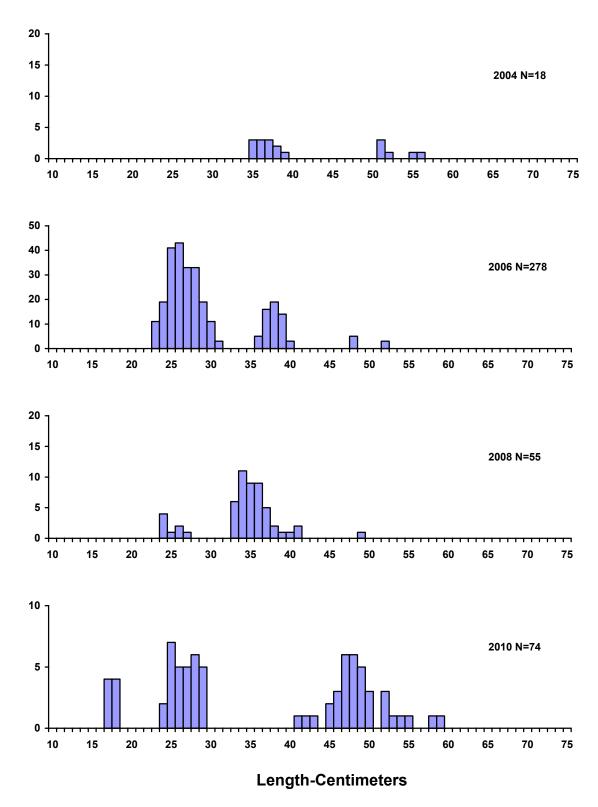


Figure1. Length frequency histograms of walleye from Brush Lake, Brookings County, 2004, 2006, 2008, and 2010.

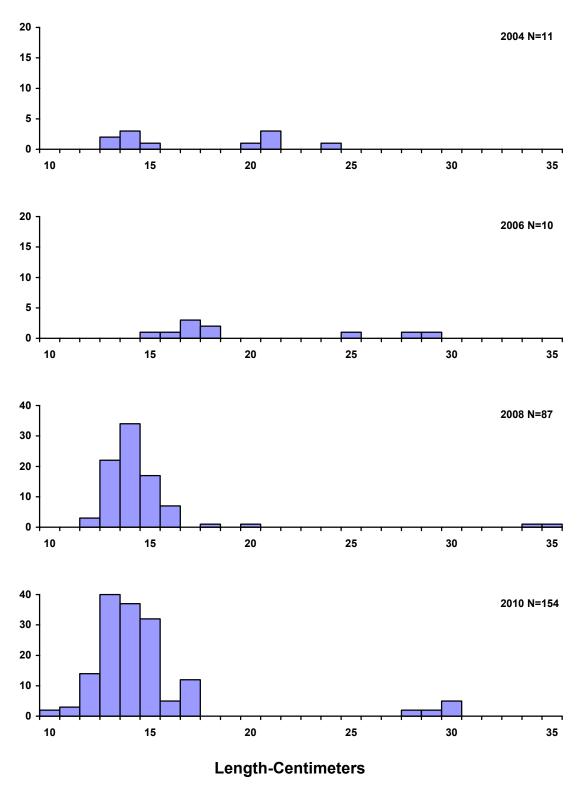


Figure 2. Length frequency histograms of yellow perch from Brush Lake, Brookings County, 2004, 2006, 2008, and 2010.

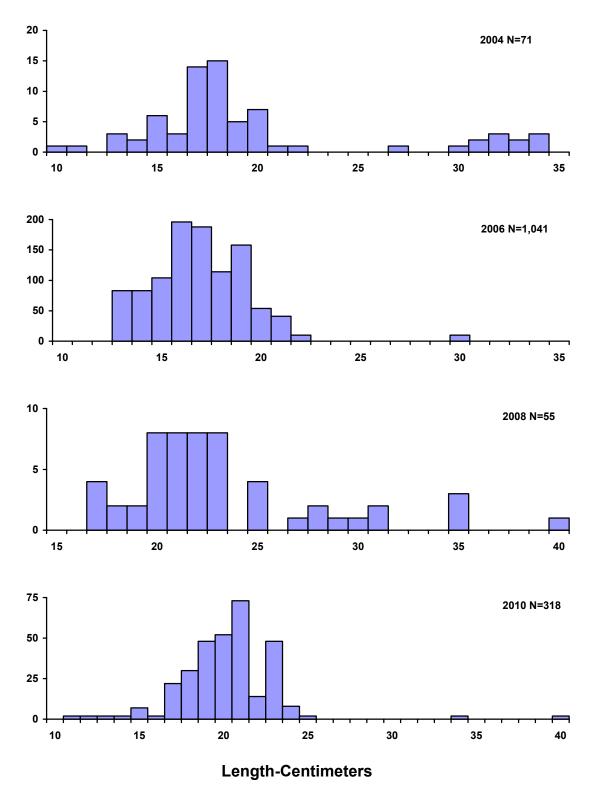
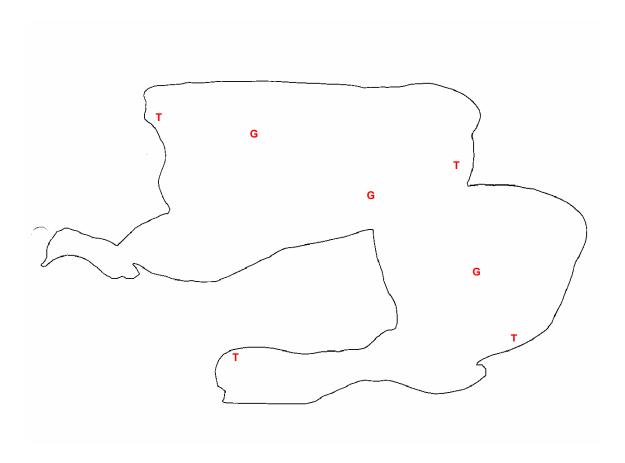


Figure 3 Length frequency histograms of black bullheads from Brush Lake, Brookings County, 2004, 2006, 2008, and 2010.

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Legend Gill Net Sites: G Trap Net Sites: T

Figure 4. Sampling locations on Brush Lake, Brookings County, 2010.

Appendix A. A brief explanation of catch per unit effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr).

Catch Per Unit Effort (CPUE) is the catch of animals in numbers or in weight taken by a defined period of effort. Can refer to trap-net nights of effort, gill-net nights of effort, catch per hour of electrofishing, etc.

Proportional Stock Density (PSD) is calculated by the following formula:

PSD = Number of fish > quality length x 100 Number of fish > stock length

Relative Stock Density (RSD-P) is calculated by the following formula:

RSD-P = Number of fish > preferred length x 100 Number of fish > stock length

PSD and RSD-P are unitless and usually calculated to the nearest whole digit.

Size categories for selected species found in Region 3 lake surveys, in centimeters (inches in parenthesis).

Species	Stock	Quality	Preferred	Memorable	Trophy
Walleye	25 (10)	38 (15)	51 (20)	63 (25)	76 (30)
Yellow perch	13 (5)	20 (8)	25 (10)	30 (12)	38 (15)
Black crappie	13 (5)	20 (8)	25(10)	30 (12)	38 (15)
White crappie	13 (5)	20 (8)	25(10)	30 (12)	38 (15)
Bluegill	8 (3)	15 (6)	20 (8)	25 (10)	30 (12)
Largemouth bass	20 (8)	30 (12)	38 (15)	51 (20)	63 (25)
Smallmouth bass	18 (7)	28 (11)	35(14)	43 (17)	51 (20)
Northern pike	35 (14)	53 (21)	71 (28)	86 (34)	112 (44)
Channel catfish	28 (11)	41 (16)	61 (24)	71 (28)	91 (36)
Black bullhead	15 (6)	23 (9)	30 (12)	38 (15)	46 (18)
Common carp	28 (11)	41 (16)	53 (21)	66 (26)	84 (33)
Bigmouth buffalo	28 (11)	41 (16)	53 (21)	66 (26)	84 (33)

For most fish, 30-60 or 40-70 are typical objective ranges for "balanced" populations. Values less than the objective range indicate a population dominated by small fish while values greater than the objective range indicate a population comprised mainly of large fish.

Relative weight (Wr) is a condition index that quantifies fish condition (i.e., how much does a fish weigh for its length). A Wr range of 90-100 is a typical objective for most fish species. When mean Wr values are well below 100 for a size group, problems may exist in food and feeding relationships. When mean Wr values are well above 100 for a size group, fish may not be making the best use of available prey.